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ABSTRACT

An alternative to the traditional lecture method for teaching mathematics to occupational/technical students has been developed at Paul D. Camp Community College in Virginia. Fundamental to the new system is the need for the student to see the relevance of his studies to his occupational goals, as seemingly irrelevant material presents a motivational problem. An effort was made to structure mathematics courses to fit specific student needs within each occupational program. Mathematical skills were broken into groups, and the skills essential to each program were determined. Common blocks of mathematics instruction in fractions, decimals, etc., were supplemented by problems tailored to and written in the individual occupational jargon. Students studied the blocks at their own pace, and tests were administered at the end of each block. Some students complete their math requirement in one quarter; others may take four or five quarters. A mathematics laboratory with a math instructor and an audiotutorial system for the basic arithmetic program are included in the program. Although there is no statistical data with which to evaluate the program at this time, preliminary reports with respect to learning and dropout rates are favorable. (AH)

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A NON-TRADITIONAL METHOD FOR TEACHING MATHEMATICS TO OCCUPATIONAL/TECHNICAL STUDENTS

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A NON TRADITIONAL METHOD FOR TEACHING MATHEMATICS

TO OCCUPATIONAL/TECHNICAL STUDENTS

Paul D. Camp Community College is a two year state institution operating within the Virginia Community College System. The college, which is now in its fourth year of operation, is devoted to serving community needs by offering a wide spectrum of programs. One of the most important offerings is occupational/technical education. The occupational/technical programs are designed to meet the ever increasing demand for skilled graduates for employment within the area served by the college. An occupational/technical student at Paul D. Camp may enter into various programs of study in either a two year associate in applied science degree program or a one year certificate program. Since the demands of one occupational program are quite different from the demands of another; the needs of the student varies from program to program. One of the areas where this variance is most apparent is in Mathematics training. Mathematics seems to be the study area with which this type of student has the most difficulty.

During the first two years of the college's operation all the Mathematics courses, except the developmental (remedial), were taught by the traditional lecture method. The certificate students all took a Math course in one lecture section; while the two year A.A.S. students all took a different Math course taught at a higher level. It soon became apparent to those teaching the courses during this time that the traditional lecture method was not working. One reason for this, especially among the certificate students, was the lack of student motivation to learn seemingly irrelevant material. The mathematics needed by a drafting student, for example is much different from that required by a student studying electrical programs. Even in mathematical areas where the particular subject matter needs of one program overlap those of another; the material in the

texts did not seem to pertain to student needs. This was principally because the material and problems used were not couched in the technical language of all occupational programs and hence the student's language. The student could not see the relevance of the material being presented and was not motivated to learn it. Thus the occupational/technical students were not gaining the mathematical competence to succeed in their programs and eventually in their chosen field of endeavor. It was therefore felt that there existed a need to individualize the mathematics course to meet the needs of each program area.

It has been shown that students often experience significant gains in learning when that learning is made an integral part of the student's career objectives. Consequently, an effort was made at Paul D. Camp Community College to structure this mathematics course to fit the specific student needs within each occupational program. To better accomplish this objective, a federally funded grant was obtained which provided funds for needed equipment and release time for one technical and two mathematics instructors to work on this project.

The researchers began by making a list containing 25 major arithmetic subjects which they believed contained the majority of the mathematical material required for all the occupational programs. Each major heading was further broken down into subheadings for a total of 169. This list was then distributed to each of the occupational/technical program heads (which used this course) to determine specific program needs for each of the subheadings listed, plus any which had been omitted from the list. The program heads were asked to indicate by each subheading that area of Mathematics which was for their program (1) absolutely required (2) nice to have or (3) not needed.

After evaluating these results and after much consultation with each occupational instructor twenty-two (22) separate blocks of instruction were developed.

Based upon the previously identified needs, a separate course outline for each occupational program was prepared. Eight (8) blocks of instruction containing common subjects such as fractions, decimals, whole numbers and percentages where found in the textbook "Basic Arithmetic" (Moon et.al.) which was already used in the developmental mathematics classes. These blocks were each supplemented by problems which were tailored to and written in the individual occupational language. In developing these supplemental problems, the researchers used specialized occupational literature and consulted with the occupational instructors. Whenever possible, the "jargon" of the particular occupational area was used. For example a machinist may be given decimal dimensions for a part to be manufactured and asked to determine the total length of the part; whereas, an electrician may be given the voltage drop across several elements in series and asked to determine the total voltage drop. Mathematically we use the same numbers, but the language is different.

In addition to using the eight (8) blocks of instruction from "Basic Arithmetic", fourteen (14) additional specialized blocks were written to cover material required in one or more occupational field, but either not covered at all or not covered in sufficient detail in the basic text. Examples of these are instructional blocks on triangles, solids, graphs, geometric construction, measurements, measuring instruments, screw threads, and work and power. The content of each block was specifically tailored to fit the needs of the specific occupations for which it was developed. In addition, since on-the-job workers use instructional aids such as tables of formulae, charts, etc.; the use of these was not only taught but encouraged during tests and examinations.

For each block of instruction three tests were prepared. After completing each block of instruction, the student is given the first block test. If the student does not pass with a satisfactory grade of 80%, he is given review material to study on his own under the supervision of the instructor then a second test on

that section is given. If he fails a second time, more review is provided and then the third test is given. After the third test a student is permitted to proceed regardless of grade since it is believed that to further hold back a student might destroy his desire to study. The instructor, by means of individual files and records, plus daily consultation and nearly daily grading, closely monitors the progress of each student. The student is constantly encouraged to progress as rapidly as he can at his best learning rate. The basic philosophy is that a student can proceed at his own pace completing the two or three required quarters of occupational mathematics needed for his program. Since each student sets his own pace, some take as little as one quarter while others take as many as four or five quarters to complete their math requirements.

Since this individualized instruction is the same type used in our developmental courses, we combined the two into a mathematics laboratory and have numerous three hour sections per week, as well as over eight (8) hours of free time when a mathematics instructor is present in the laboratory. Since our student body includes many part-time students who work swing shifts, alternating between day and evening schedules, the procedure of allowing the student to come at any time when the laboratory is open was adopted. Such a system requires extensive recordkeeping and although one instructor alone is responsible for presenting grades to the administration, every math instructor may contribute to the instruction. This system sounds rather loosely organized, but in reality, while flexible, is rigid enough to enable students to learn at their own pace.

The simultaneous introduction of the audio-tutorial system in the "Basic Arithmetic" portion has proven to be exceedingly helpful. Several of our students have a reading level comprehensior on the Nelson-Denny Comprehensive Test of 7.0 to 8.5 grade level, which under previous types of instruction resulted in longer

learning periods. With the audio-tutorial system his learning period has been shortened, apparently because the two senses of sight and hearing reinforcing each other in this system permitting these students to progress at nearly normal rates. A further result is that when these students advance past the "Basic Arithmetic" portion of the course, they seem to have gained the necessary skills in mathematics and reading to progress satisfactorily without the audio assistance.

While it is as yet too early to adequately evaluate the program, reports have been favorable. Dropouts from mathematics have been fewer than under the old system. We strongly feel that definite results can be and are being achieved in mathematics instruction, and that we are proceeding in the proper direction with individualization and specialization of our occupational mathematics programs.

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